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(54) Gas displacement device for packaging food and non-food products

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Description

Field of Invention

This invention generally relates to an apparatus and a method for removing oxygen from the headspace of a container filled with solid or liquid material prior to closing an opening in the top of said container. In particular, it relates to a device and method for substituting an inert gas for atmospheric air in the headspace of gable-top paperboard cartons.

Background Art

In general, foods, medicines, cosmetics and other substances packaged in containers are oxidized by ambient air, resulting in degradation of the quality of the substance. In the prior art it is well known to remove oxygen from the headspace of a container by replacing the ambient air in the headspace with inert gas during filling of the containers.

In particular, oxidative degradation is one of the major causes of the spoilage of sterlized packaged food product. This degradation is the result of direct contact of oxygen with the food product and reaction therebetween during extended storage of the packaged food product. The spoilage is increased at higher storage temperatures. Certain non-food products must also be protected from oxygen.

While expensive packaging can be designed to keep oxygen away from the food product, certain products must be packaged with a headspace volume for mixing and pouring. When the headspace is filled with ambient air, the headspace volume contains 21 % oxygen which should be removed.

A prior art apparatus for reducing the amount of oxygen in the headspace of a gable-top container is disclosed in U.S. Patent No. 4,869,047 to Nishiguchi et al. In accordance with this teaching, a gas substitution station with a pair of inert gas-filling nozzles is arranged between the filling and top sealing stations. The first nozzle has a greater area than the second nozzle. Inert gas injected into the headspace by the first nozzle displaces the ambient air. The second nozzle is arranged to inject more inert gas into the headspace as the top fins of the carton are being brought toward each other preparatory to the top sealing step.

The arrangement of Nishiguchi et al. suffers from the disadvantage that because the outlet of the nozzle is circular and the cross section of the carton is square, the ambient air in the corners of the carton is not easily displaced. Moreover, for the foregoing reason and further because the injected inert gas initially flows radially outward and then upward along the inner wall of the carton, turbulent flow can result which serves to trap ambient air in the headspace.

Another arrangement for reducing the amount of oxygen in the headspace of a container is disclosed in U.S. Patent No. 4,870,801 to Mizandjian et al. In accordance with this teaching, deoxygenation of each container is performed under inert atmosphere by means of two simultaneous injections of inert gas. The inerting device comprises an insulating cap for preventing the entry of oxygen into the packages, an inert gas feed circuit for filling the cap with inert gas and a purging gas feed circuit for flushing the packages with inert gas.

Although Mizandjian asserts that their method results in a reduction of the oxygen content to below 2 %, the arrangement disclosed is disadvantageous because it requires a complex injector design.

A further arrangement for reducing the amount of oxygen in the headspace of a container is disclosed in U.S. Patent No. 4,936,127 to Risko et al. In accordance with this teaching nitrogen enters the headspace container chamber and is directed downwardly through a diffuser screen and forwardly by the first pair of baffles into the leading carton of a pair of double indexed cartons and downwardly and rearwardly by the second pair of baffles into the trailing carton of the pair of cartons. A pair of longitudinally oriented shields serve to prevent the nitrogen from flowing off to the sides of the open-topped cartons.

Risko et al. discloses oxygen residuals from 1 to 3 % in the cartons after being flooded with a nitrogen flow from 0.37 to 0.92m^3/min. The apparatus is incorporated between the filling and top forming units of machines having cooperating turret and conveyer mechanisms for indexing aligned pairs of cartons therealong. The arrangement of Risko is thus limited and would not allow for flushing a succession of continuously moving cartons.

Using conventional packaging machines running at standard form/fill/seal rates, it has been possible to reduce the amount of oxygen in the headspace from 21 % to 3-6 % by volume. Such conventional packaging machines employ equipment for flushing the headspace with an inert gas such as nitrogen, which is substituted for the ambient air in the carton headspace.

However, oxygen levels of 3-6 % by volume in the headspace are too high to provide optimum protection against degradation for those food products requiring a shelf-life of at least one year at room temperature and under dry-shelf storage conditions. Instead a headspace oxygen level averaging less than 1 % by volume is required.

Disclosure of the Invention

It is an object of the invention to overcome the aforementioned disadvantages of conventional packaging machines. In particular, it is an object of the invention to provide an apparatus and a method for reducing the amount of oxygen in the headspace of a container to less than 1% by volume.

Another object of the invention is to provide a simple device for flushing the headspace of a gable-top paperboard carton with an inert gas.

Yet another object of the invention is to provide a stationary gas substitution device which provides a continuous flow of inert gas to a volume through which pass a succession of continuously moving containers.

Another object of the invention is to provide an apparatus and a method for flushing cartons to less than 1% volume oxygen without disturbing the product in the carton, adversely affecting the seal quality or bulging the carton.

A further object of the invention is to provide a method for removing oxygen from the headspace of a container wherein the container is moved continuously during flushing with inert gas.

Another object of the invention is to provide a method for removing oxygen from the headspace of a container which is relatively inexpensive and adaptable for use in-line in conventional form/fill/seal apparatus lines.

In the present invention, these objects, as well as others which will be apparent, are achieved for the device or apparatus by the features defined in claim 1. For the method these objects are achieved according to the present invention by the features defined in claim 5. By the present invention there is provided an inert gas dispersion device which efficiently directs inert gases into the headspace of a container moving relative thereto. This is accomplished by outputting a large volume of inert gas which blankets the headspace area of the container at low inert gas velocity, thereby displacing the ambient air in the headspace.

In accordance with the invention, the device comprises a tubular connection to a source of inert gas and a hood with a chamber which communicates with an outlet of the tubular connection. The chamber includes an aperture which is configured to overlie the headspace of a container which passes thereunder. A preferred embodiment is designed to accommodate the specifications of conventional gable-top containers which have a generally square cross-section. Accordingly, the aperture of the preferred embodiment has a rectangular cross-section, with a width in a direction transverse to the direction of movement of the container which is less than the container width measured along that same direction, and a length in the direction of container movement which is greater than the container length measured along the direction of movement.

The length in the direction of container movement of the portion of the aperture which overlies the open top of the container varies continuously from zero to the length of the container measured in that direction during a first portion of the path of the container underneath the aperture; is constant and equal to the container length during a second portion of the path of the container underneath the aperture; and varies continuously from the container length to zero during a third portion of the path of the container underneath the aperture. The width in the transverse direction of the portion of the outlet which overlies the open top is constant and equal to the width of the aperture during the second portion of the path of the container underneath the aperture.

The gas displacement device in accordance with the invention flushes the ambient air from the headspace of a container by dispersing gaseous nitrogen or other inert gas or mixture of inert gases into the container headspace. The invention is particularly suited for use in-line a conventional form/fill/seal carton line for removing oxygen from the headspace of paperboard cartons. As set forth above, the preferred embodiment of the invention is designed for use in gable-top container applications, however, the invention is not limited to any particular container configuration. The configuration of the aperture may be modified as required to meet specifications of other carton designs.

In the preferred embodiment, gaseous nitrogen from a tank of liquid nitrogen or other source is used as the flush gas. High-velocity gas from the cylinder of liquid nitrogen is expanded to at least four times its volume to reduce its velocity and then is passed through the displacement device into the headspace of a carton moving on a conveyor belt. Gas velocity is reduced at least by a factor of 4 to a maximum velocity of about 121,9 to 182,88 meters (400 to 600 feet) per minute at the carton headspace. The flushing period of the preferred embodiment is approximately four seconds per carton. Empirical data shows that at least 60 times the headspace volume of a filled carton or seven times the volume of an empty carton is required to reduce the oxygen content to less than 1% by volume, although the method of the invention is not necessarily limited to these values.

On a conventional form/fill/seal line, the device is situated immediately between the top heater and sealer sections. Advantageously, the device provides an inert gas pathway for movement of cartons on the line within which carton closure is effected in the sealer section by operation of conventional apparatus such as sealer jaws. Exit areas

in the device are provided for ambient air displaced in the dispersion process of the invention.

Other objects, features and advantages of the present invention will be apparent from the detailed description of the preferred embodiment of the invention which follows.

Brief Description of the Drawings

The preferred embodiment of the invention will now be described in detail with reference to the drawings, wherein:

FIG. 1 is a side view of a gas displacement device in accordance with the preferred embodiment of the invention.

FIG. 2 is a bottom view of the preferred embodiment of the invention depicted in FIG. 1.

FIG. 3 is a top view of the preferred embodiment of the invention depicted in FIG. 1.

FIG. 4 is a end view of the preferred embodiment of the invention depicted in FIG. 1.

FIG. 5 is a side view of the preferred embodiment of the invention showing the position of the device relative to the moving cartons passing thereunder.

FIG. 6 is a theoretical illustration of ambient air and inert gas flow pattern obtained in operation of gas displacement device of the invention.

Best Mode Of Carrying Out The Invention

Referring to FIG. 1, the gas displacement device 2 in accordance with the preferred embodiment of the invention comprises tubing 4 having a cylindrical channel 6 and a pipe 8 connected to tubing 4 and having a cylindrical channel 10 which communicates with channel 6. The diameter of channel 10 is greater than the diameter of channel 6.

The pipe 8 further has an end portion 12 of reduced outer diameter which is designed to couple with a hole 14 formed in a hood 16. The outer surface of end portion 12 and the inner surface of hole 14 may be threaded for mutual engagement. Alternatively, the outer surface of end portion 12 and inner surface of hole 14 may be smooth, with corresponding diametral dimensions such that end portion 12 can be press-fitted into hole 14.

Tube 4 and pipe 8 are preferably made of stainless steel or functionally equivalent material; and hood 16 is preferably made of aluminum or stainless steel. In the preferred embodiment, tube 4 is 1,27 cm X 0,0889 cm (1/2" X .035")stainless steel tubing; pipe 8 is stainless steel pipe with an internal diameter of 2,54 cm (1") milled to 1/81,28 cm (1/32"); and hood 16 has outer dimensions of 14,287 cm (5 5/8") X 7,62 cm (3) and 2,223 cm (7/8") X 4,445 cm (1 3/4") when used in conjunction with half-gallon paperboard cartons. In the top view of FIG. 3, tube 6 and pipe 8 appear in section.

The hood 16 has a circular cylindrical channel 18 which communicates with channel 10 of pipe 8 when the end of pipe 8 is mounted in hole 14. Hood 16 also has a chamber 20 which communicates with channel 18 via an elliptical opening 22. Chamber 20 is formed by an inclined planar top wall 24 and a peripheral wall 26. As is best shown in FIG. 1, the height of chamber 20 varies linearly in a lengthwise direction. Peripheral wall 26 has a substantially rectangular cross section with rounded corners and forms an aperture 28 of the same shape. See FIG. 2. Aperture 28 communicates with opening 22 via chamber 20. A blanket of inert gas passes through aperture 28, as discussed in more detail below.

Conventional gable-top half-gallon paperboard cartons have a square cross section and a side dimension of 9,525 cm (3 3/4"). Accordingly, the dimensions of the hood are generally dictated by the need to conform to the dimensions of the cartons. For example, in the preferred embodiment of the device for use with standard half-gallon gable-top paperboard cartons, the front wall of chamber 26 has a height of 1,9843 cm (25/32"); the rear wall of chamber 26 has a height of 1,19 cm (15/32"); and aperture 28 has a width of 7,3025 cm (2 7/8") and a length of 12,144 cm (4 25/32"). However, the dimensions of the hood may vary in dependence on the size of the carton.

As best seen in FIG. 5, containers 40 and 40' are conveyed under the hood 16 in a lengthwise direction (denoted by arrow A) by a conveyor belt (not shown). In accordance with the preferred embodiment of the invention described herein, those containers have a square cross-section. The hood is arranged at a height such that aperture 28 is separated from the open tops of the containers thereunder by a predetermined gap denoted by the letter "h" in FIG. 1. In the preferred embodiment, which has application for use in processing standard half-gallon gable-top paperboard cartons, "h" equals 0,238 cm (3/32").

Aperture 28 is flanked on both sides by a pair of mutually parallel longitudinal protrusions 30, which form the bottommost portions of hood 16 (see FIG. 2). Protrusions 30 form of linear bars which are an integral part of the hood. Each protrusion has a planar bottom surface 32 and a planar inner side surface 34 of height "h". The bottom surfaces 32 are arranged such that opposing longitudinal side edges of the open tops of the containers 40 and 40' oppose the respective surfaces and slide thereunder with a minimum space 38 therebetween (see FIG. 5). In the preferred embodiment, the bottom surfaces have a width of 0,635 cm (1/4") and a length of 14,287 cm (5 5/8")

and are separated by a distance "d" equal to 0,857 cm (3 3/8") (see FIG. 4). Thus, the inner edges of the bottom surfaces 34 are separated by a distance of 0,857 cm (3 3/8"), whereas the outer edges are separated by a distance of 9,842 cm (3 7/8"). Since the side dimension of a standard half-gallon gable-top paperboard carton of square cross section is 9,525 cm (3 3/4"), cartons on the line are positioned such that the top edges of each carton are aligned in the direction of carton movement and lie directly under the opposing bottom surface 34.

The other pair of opposing top edges of the open carton positioned under the hood 16 extend from one bottom surface 34 to the other and are separated from the planar bottom surface 36, which surrounds aperture 28, by the predetermined gap "h". These top edges cooperate with the leading and trailing portions of bottom surface 36 of hood 16 to form exit slits of rectangular shape and having dimensions h X d, that is 0,238 cm, (3/32") by 0,857 cm (3 3/8"), for the escape of ambient air displaced by the nitrogen gas which is flushed into the headspace.

Further, in accordance with the preferred embodiment disclosed herein, the front edge of aperture 28 is separated from the front edge of bottom surface 36 by a distance of 0,952 cm (3/8"); the back edge of aperture 28 is separated from the back edge of bottom surface 36 by a distance of 1,1906 cm (15/32"); and the side edges of aperture 28 are separated from the respective protrusions 30, 36 by a distance of 0,635 cm (1/4"). Also circular cylindrical channel 18 has a diameter of 2,54 cm (1") and is equidistant from the longitudinal sides of the hood and is separated from the rear end of the hood by a distance of 2,54 cm (1").

The device of the invention is particularly suited for use in-line on a conventional form/fill/seal carton line, situated at a station between a top heater and sealer sections. In accordance with the invention, a blanket of inert gas, preferably nitrogen, blankets the headspace of each carton which passes thereunder. A tunnel of inert gas continues to blanket each carton as it advances into and is sealed by operation of sealer jaws or other conventional apparatus in the sealer section. As the moving conveyor belt conveys each carton under the hood, an increasing area of the aperture 28 overlies the open top of the carton. The length in the direction of carton movement of the portion of the aperture which overlies the open top varies continuously from zero to 9,525 cm (3 3/4"), i.e., the full length of the open top of a standard half-gallon gable-top paperboard carton; is equal to 9,525 cm (3 3/4") during the next 2,619 cm (1 1/32") of carton travel; and varies continuously from 9,525 cm (3 3/4") to zero thereafter. Thus, the blanket of inert gas is effectively swept across the open top of the carton, starting with the leading edge of the carton. The nitrogen gas flushed into the headspace of the carton displaces the ambient air therein, thereby reducing the oxygen content of the headspace to levels of less than 1%.

FIG. 6 is a theoretical illustration of ambient air and inert gas flow pattern obtained in operation of gas displacement device. It is believed that advantage in the invention is obtained by provision of high volume and low velocity inert gas flow currents which blanket the carton headspace. As illustrated in FIG. 6, the gas displacement device produces a laminar and non-turbulent flow of inert gas within the carton headspace area. Ambient air in the carton headspace is gradually displaced through the corners and sides of the carton. Laminar flow of the dispersing gas limits back currents or mixing of ambient air into the carton to obtain the oxygen dispersal efficiencies of the invention.

It will be recognized by those skilled in the art, that process line parameters for applications of the dispersal device are a function of carton volume and line speed which must be adjusted to accommodate particular line applications of the invention. In the preferred embodiment, high-velocity gaseous nitrogen is expanded to at least four times its volume to reduce its velocity and then passed to the displacement device. Gas velocity is reduced at least by a factor of 4 to a maximum velocity of about 121,9 to 182,88 meters (400 to 600 feet) per minute at the carton headspace. At these preferred line parameters the flushing period for each carton is approximately four seconds. Empirical data show that at least 60 times the headspace volume of a filled carton or seven times the volume of an empty carton is required to reduce the oxygen content to less than 1% by volume. The foregoing process parameters are representative of a preferred process application of the dispersion device; the invention method is not limited to these values.

From the foregoing, it will be recognized that modifications are possible. For example, although the preferred embodiment employs gaseous nitrogen or other inert gas, mixtures of such gases may be employed in the invention. Similarly, mixtures of inert gas, oxygen and other gaseous substances may be introduced into product packaging employing the dispersion device of the invention. Thus, while principal objective of the invention is to disperse oxygen from headspace in carton headspace areas, the displacement device may also be employed as a mechanism for controlled dispersal and/or injection of oxygen or other gases into cartons to prescribed levels.

Therefore, although the invention has been described with reference to certain preferred embodi-

ments, it will be appreciated that other composite structures and processes for their fabrication may be devised, which are nevertheless within the scope of the claims appended hereto.

Claims

1. A gas displacement device for substituting inert gas for ambient air in the headspace of a container (40, 40') prior to closing an opening in the top of said container, comprising:
a hood (16) having a passageway (18) with a first opening (14) and a second opening (22) at respective open ends thereof, said passageway being a circular cylindrical section, and further having a recess (20) which communicates with said passageway via said second opening (22), said recess having a peripheral edge which is a closed contour lying in a horizontal plane, said peripheral edge of said recess defining a third opening (28) in said hood;
means (8) for supplying a pressurized stream of inert gas to said first opening; and means for linearly displacing said container (40, 40') in a predetermined horizontal direction from a first position to a second position such that inert gas exiting said second opening is injected into said headspace when said container is at said first position and is not injected into said headspace when said container is at said second position, at least some portion of said recess overlying at least some portion of said container opening at said first and second positions and every position therebetween, wherein said third opening (28) has a maximum length in said direction of displacement which is greater than the maximum dimension of said container opening in said direction of displacement, and
whereby when said container (40, 40') is in said first position, said recess (20) acts as a tunnel through which a blanket of gases flows in a downstream direction which is generally parallel to said direction of container displacement, said downstream flowing gases overlying said headspace when said container (40, 40') is displaced to said second position,
wherein said recess (20) is defined in part by a planar upper wall (24) which is inclined relative to a horizontal plane and which is co-planar with said second opening (22), the height of said inclined upper wall (24) increasing linearly in said direction of displacement, and is defined in part by a substantially cylindrical side wall (26) terminating at said peripheral edge which forms said third opening (28), said side wall (26) comprising first and second straight portions disposed substantially vertical and substantially parallel to said direction of displacement, said first and second straight portions being separated by a distance which is less than the maximum dimension of said container opening in a direction transverse to said direction of displacement.

2. The gas displacement device as defined in claim 1, wherein said third opening (28) of said hood has the shape of a rectangle with rounded corners.

3. The gas displacement device as defined in claim 1, wherein said inert gas is nitrogen.

4. The gas displacement device as defined in claim 1, wherein said hood (16) comprises first and second rails (30) flanking said third opening and substantially aligned in said direction of displacement such that said first and second rails oppose respective side edges of said container (40, 40') opening to form respective minimal gaps therebetween, whereby the flow of air displaced from said container through said gaps is minimized.

5. A method for substituting inert gas for ambient air in the headspace of a container (40, 40') prior to closing of an opening of said container (40, 40'), comprising the steps of:
displacing said container (40, 40') along a straight path in a predetermined horizontal direction from a first position to a second position;
injecting a stream of inert gas generally downward from an outlet toward said headspace via an inverted recess (20) as said container (40, 40') travels from said first position to said second position along said path, said inverted recess (20) having a peripheral edge (28) which is a closed contour lying in a horizontal plane, a portion of said inert gas entering said headspace to displace gases inside said headspace until less than 1 % oxygen remains in said headspace;
wherein, said recess (20) acts as a tunnel through which said displaced gases flow in the general direction of said predetermined horizontal direction when said container (40, 40') is at said second position, said displaced gases in said recess (20) overlying said headspace when said container (40, 40') is further displaced to a third position along said path at which inert gases are no longer injected into said headspace; channeling gas which has been displaced out of said headspace to flow in said predetermined horizontal direction

through a volume located at an elevation which is higher than the elevation of said headspace; and
redirecting said channeled gas in a generally downward direction.

6. The method as defined in claim 5, wherein said container (40, 40') comprises a gable-top paperboard carton.

7. The method as defined in anyone of claims 5 or 6, wherein said container (40, 40') is filled with solid or fluid material except for said headspace, and said inert gas enters said headspace at a velocity of less than 182,88 meters (600 feet) per minute.

8. The method as defined in anyone of claims 5 or 6, wherein said container (40, 40') is flushed with a volume of inert gas equal to at least seven times the volume of said container.

Patentansprüche

1. Gas-Verdrängungsvorrichtung zum Ersetzen von Umgebungsluft in dem Verschlußraum eines Behälters (40, 40') durch Inertgas vor dem Verschließen einer Öffnung im Kopfbereich des Behälters, umfassend:
eine Kappe (16) umfassend eine Durchlaßstrecke (18), die einen umlaufenden zylindrischen Abschnitt bildet und eine erste Öffnung (14) und eine zweite Öffnung (22) an ihren jeweiligen offenen Enden aufweist, und des weiteren umfassend eine Aussparung (20), die mit der Durchlaßstrecke über die zweite Öffnung (22) in Verbindung steht, wobei die Aussparung einen äußeren Rand aufweist, der einen in einer horizontalen Ebene liegenden geschlossenen Umriß bildet und eine dritte Öffnung (28) in der Kappe definiert;
Mittel (8) zur Zuführung einer unter Überdruck stehenden Strömung von Inertgas zu der ersten Öffnung; und
Mittel zur linearen Verschiebung des Behälters (40, 40') derart in eine vorbestimmte horizontale Richtung von einer ersten Stellung in eine zweite Stellung, daß das aus der zweiten Öffnung austretende Inertgas in den Verschlußraum eingeleitet wird, wenn der Behälter in der ersten Stellung ist, und nicht in den Verschlußraum eingeleitet wird, wenn der Behälter in der zweiten Stellung ist, wobei wenigstens einige Bereiche der Aussparung wenigstens einige Bereiche der Behälteröffnung in der ersten und zweiten Stellung und jeder zwischenliegenden Stellung überdecken,
dadurch gekennzeichnet,
daß die dritte Öffnung (28) eine maximale Länge in Verschiebungsrichtung aufweist, die größer ist als die maximale Ausdehnung der Behälteröffnung in Verschiebungsrichtung,
daß die Aussparung (20) als ein Tunnel wirkt, wenn sich der Behälter (40, 40') in der ersten Stellung befindet, durch den Schutzgas in Stromabwärtsrichtung strömt, die im allgemeinen parallel zur Verschiebungsrichtung des Behälters ist, wobei die stromabwärts strömenden Gase den Verschlußbereich überdecken, wenn der Behälter (40, 40') in die zweite Stellung verschoben wird, daß die Aussparung (20) teilweise von einer ebenen oberen Wand (24) begrenzt wird, die in bezug zu einer horizontalen Ebene geneigt ist und in einer Ebene mit der zweiten Öffnung (22) liegt, wobei die Höhe der geneigten oberen Wand (24) linear in Verschiebungsrichtung ansteigt und teilweise durch eine im wesentlichen zylindrische Seitenwand (26) begrenzt ist, die an dem äußeren Rand abschließt, welche die dritte Öffnung (28) bildet, und daß die Seitenwand (26) erste und zweite gerade Bereiche aufweist, die im wesentlichen senkrecht und im wesentlichen parallel zu der Verschiebungsrichtung angeordnet und durch einen Abstand voneinander getrennt sind, der kleiner ist als die maximale Ausdehnung der Behälteröffnung in einer Richtung quer zu der Verschiebungsrichtung.

2. Gas-Verdrängungsvorrichtung nach Anspruch 1,
dadurch gekennzeichnet,
daß die dritte Öffnung (28) der Kappe die Form eines Rechtecks mit abgerundeten Ecken aufweist.

3. Gas-Verdrängungsvorrichtung nach Anspruch 1,
dadurch gekennzeichnet,
daß das Inertgas Stickstoff ist.

4. Gas-Verdrängungsvorrichtung nach Anspruch 1,
dadurch gekennzeichnet,
daß die Kappe (16) erste und zweite Schienen (30) aufweist, die die dritte Öffnung flankieren und im wesentlichen derart in Verschiebungsrichtung ausgerichtet sind, daß die ersten und zweiten Schienen den jeweiligen Seitenkanten der Behälteröffnung (40, 40') gegenüberliegen, um dazwischen jeweils minimale Spalte zu bilden, wodurch das Ausströmen von aus dem Behälter verdrängter Luft durch diese Spalte minimiert wird.

5. Verfahren zum Ersetzen von Umgebungsluft in dem Verschlußraum eines Behälters (40, 40') durch Inertgas vor dem Verschließen einer Öffnung des Behälters (40, 40') umfassend die folgenden Schritte:
Verschieben des Behälters (40, 40') entlang eines geraden Weges in einer vorbestimmten horizontalen Richtung von einer ersten Stellung in eine zweite Stellung;
Einleiten eines Stromes von Inertgas im allgemeinen abwärts von einem Auslaß zum Verschlußraum über eine umgekehrte Aussparung (20), während sich der Behälter (40, 40') von der ersten Stellung zur zweiten Stellung entlang des Weges bewegt, die umgekehrte Aussparung (20) weist einen äußeren Rand (28) auf, der ein in einer horizontalen Ebene liegender geschlossener Umriß ist, ein Anteil des Inertgases tritt in den Verschlußraum ein, um Gase im Innern des Verschlußraumes zu verdrängen bis weniger als 1% Sauerstoff in dem Verschlußraum verbleibt;
dadurch gekennzeichnet,
daß die Aussparung (20) als ein Tunnel wirkt, durch den die verdrängten Gase in die Hauptrichtung der vorbestimmten horizontalen Richtung strömen, wenn sich der Behälter (40, 40') in der zweiten Stellung befindet, wobei die verdrängten Gase in der Aussparung (20) den Verschlußraum überdecken, wenn der Behälter (40, 40') weiter in eine dritte Stellung entlang des Weges verschoben wird, in der kein Inertgas mehr in den Verschlußbereich eingeleitet wird;
daß Gas kanalisiert wird, das aus dem Verschlußraum verdrängt wurde, um in die vorbestimmte horizontale Richtung bis zun einem Volumen zu strömen, welches sich in einer Höhe befindet, die höher liegt als die Höhe des Verschlußraumes; und
daß das kanalisierte Gas in eine im allgemeinen abwärtsgerichtete Richtung zurückgeleitet wird.

6. Verfahren nach Anspruch 5,
dadurch gekennzeichnet,
daß der Behälter (40, 40') eine Giebel-Oberteil-Pappe aufweist.

7. Verfahren nach Anspruch 5 oder 6,
dadurch gekennzeichnet,
daß der Behälter (40, 40') mit Ausnahme des Verschlußraumes mit festem oder flüssigem Material gefüllt ist und daß das Inertgas mit einer Geschwindigkeit von weniger als 182,88 Meter (600 feet) pro Minute in den Verschlußraum eintritt.

8. Verfahren nach Anspruch 5 oder 6,
dadurch gekennzeichnet,
daß der Behälter (40, 40') mit einer Inertgasmenge ausgespült wird, die wenigstens dem siebenfachen Volumen des Behälters entspricht.

Revendications

1. Dispositif de déplacement de gaz pour remplacer l'air ambiant par un gaz inerte dans l'espace de tête d'un récipient (40, 40') avant de fermer une ouverture formée dans le sommet du récipient, comprenant : un capot (16) comportant un passage (18) muni d'une première ouverture (14) et d'une seconde ouverture (22) à ses extrémités ouvertes respectives, ce passage présentant une section cylindrique circulaire et comportant en outre une cavité (20) qui communique avec le passage par l'intermédiaire de la seconde ouverture (22), cette cavité comportant un bord périphérique constitué par un contour fermé se situant dans un plan horizontal, le bord périphérique de cette cavité définissant une troisième ouverture (28) dans le capot ; des moyens (8) pour fournir un courant de gaz inerte sous pression à la première ouverture ; et des moyens pour déplacer linéairement le récipient (40, 40') d'une première position à une seconde position dans une direction horizontale prédéterminée, de façon que le gaz inerte sortant de la seconde ouverture soit injecté dans l'espace de tête lorsque le récipient se trouve dans la première position, et ne soit pas injecté dans l'espace de tête lorsque le récipient se trouve dans la seconde position, un partie au moins de la cavité recouvrant une partie au moins de l'ouverture du récipient dans la première et le seconde position et dans toute position entre les deux, dispositif dans lequel la troisième ouverture (28) présente, dans la direction du déplacement, une longueur maximum qui est supérieure à la dimension maximum de l'ouverture du récipient dans la direction du déplacement, et de sorte que, lorsque le récipient (40, 40') se trouve dans la première position, la cavité (20) sert de tunnel par lequel une couverture de gaz s'écoute dans la direction aval qui est généralement parallèle à la direction de déplacement du récipient, ces gaz d'écoulement vers l'aval recouvrant l'espace de tête lorsque le récipient (40, 40') est déplacé vers la seconde position, et dans lequel la cavité (20) est définie en partie par une paroi supérieure plane (24) qui est inclinée par rapport à un plan horizontal et qui est coplanaire avec la seconde ouverture (22), la hauteur de cette

paroi supérieure inclinée (24) augmentant linéairement dans la direction du déplacement, et la paroi étant définie en partie par une paroi latérale essentiellement cylindrique (26) se terminant à l'endroit du bord périphérique qui forme la troisième ouverture (28), cette paroi latérale (26) comprenant une première et une seconde partie droite disposée essentiellement verticalement et essentiellement parallèlement à la direction du déplacement, cette première et cette seconde partie droite étant séparées par une distance inférieure à la dimension maximum de l'ouverture du récipient dans une direction transversale par rapport à la direction du déplacement.

2. Dispositif de déplacement de gaz selon la revendication 1, caractérisé en ce que la troisième ouverture (28) du capot a la forme d'un rectangle à coins arrondis.

3. Dispositif de déplacement de gaz selon la revendication 1, caractérisé en ce que le gaz inerte est de l'azote.

4. Dispositif de déplacement de gaz selon la revendication 1, caractérisé en ce que du capot (16) comprend un premier et un second rail (30) flanquant la troisième ouverture et essentiellement alignés dans la direction de déplacement, de façon que ce premier et ce second rail sont opposés aux bords latéraux respectifs de l'ouverture du récipient (40, 40') pour former des intervalles respectifs minimums entre les deux, ce qui permet ainsi de minimiser l'écoulement d'air déplacé du récipient par ces intervalles.

5. Procédé de remplacement de l'air ambiant par un gaz inerte dans l'espace de tête d'un récipient (40, 40') avant de fermer une ouverture de ce récipient (40, 40'), comprenant les étapes consistant à :
   - déplacer le récipient (40, 40') le long d'un chemin droit dans une direction horizontale prédéterminée, d'une première position vers une seconde position ;
   - injecter un courant de gaz inerte généralement vers le bas, depuis une ouverture de sortie et vers l'espace de tête, par une cavité inversée (20), lorsque le récipient (40, 40') passe de la première position à la seconde position le long de son chemin, cette cavité inversée (20) comportant un bord périphérique (28) qui consiste en un contour fermé se situant dans un plan horizontal, une partie du gaz inerte pénétrant dans l'espace de tête pour déplacer les gaz à l'intérieur de cet espace de tête jusqu'à ce que moins de 1 % d'oxygène subsiste dans l'espace de tête ; la cavité (20) servant de tunnel par lequel les gaz déplacés s'écoulent dans la direction générale de la direction horizontale prédéterminée lorsque le récipient (40, 40') se trouve dans la seconde position, les gaz déplacés dans la cavité (20) recouvrant l'espace de tête lorsque le récipient (40, 40') est encore déplacé, le long de son chemin, jusqu'à une troisième position dans laquelle les gaz inertes ne sont plus injectés dans l'espace de tête, canaliser les gaz ayant été déplacés hors de l'espace de tête pour qu'ils s'écoulent dans la direction horizontale prédéterminée à travers un volume situé à une hauteur plus élevée que la hauteur de l'espace de tête ; et rediriger les gaz canalisés dans une direction dirigée généralement vers le bas.

6. Procédé selon la revendication 5, caractérisé en ce que le récipient (40, 40') comprend une boîte en carton formant pignon au sommet.

7. Procédé selon l'une quelconque des revendications 5 ou 6, caractérisé en ce que le récipient (40, 40') est rempli d'un matériau solide ou fluide, sauf dans l'espace de tête, et en ce que le gaz inerte pénètre dans l'espace de tête à une vitesse inférieure à 182,88 mètres (600 pieds) par minute.

8. Procédé selon l'une quelconque des revendications 5 ou 6, caractérisé en ce que le récipient (40, 40') est rempli à ras bord par un volume de gaz inerte égal à au moins sept fois le volume du récipient.

FIG 1
SIDE

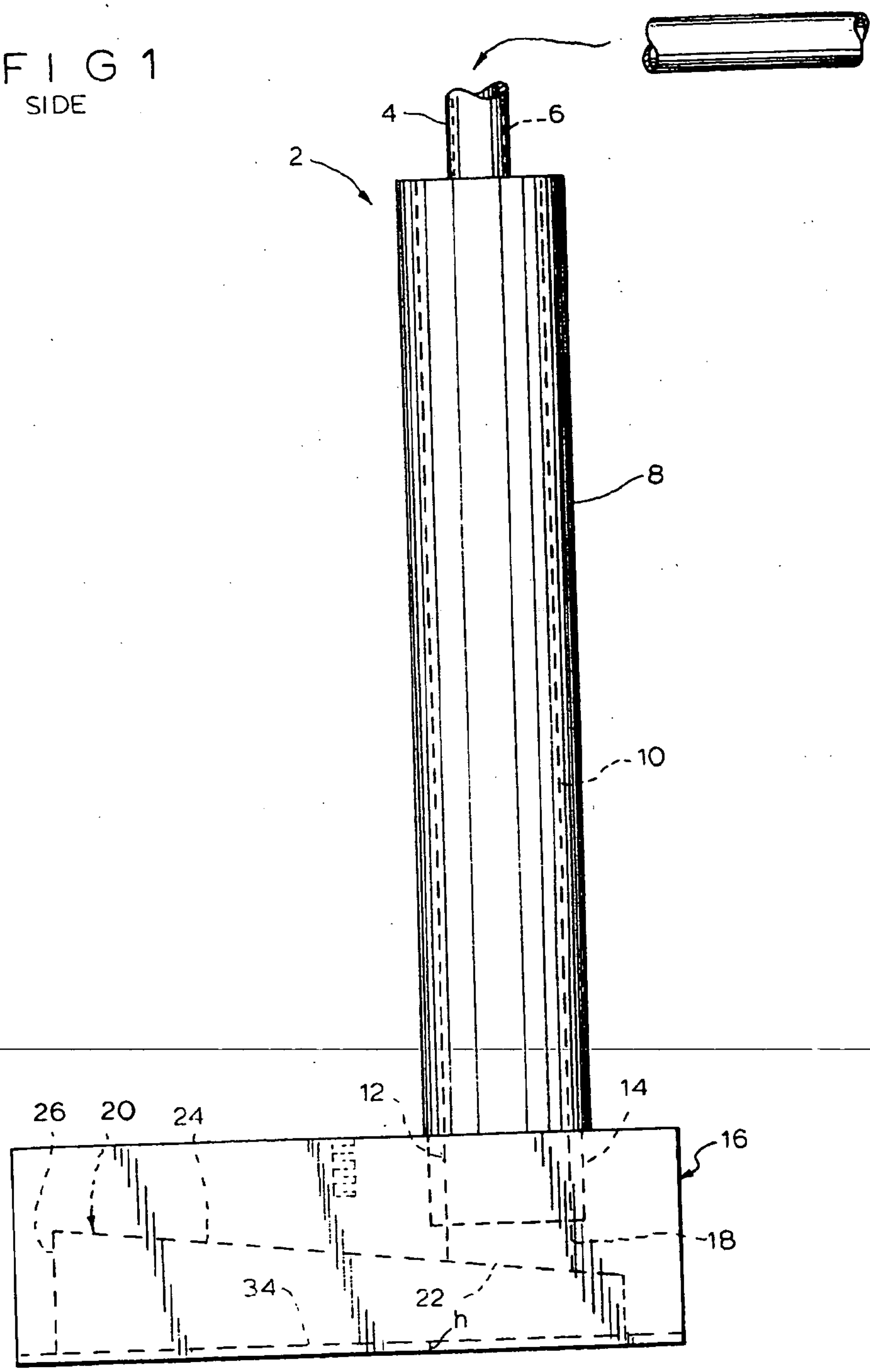
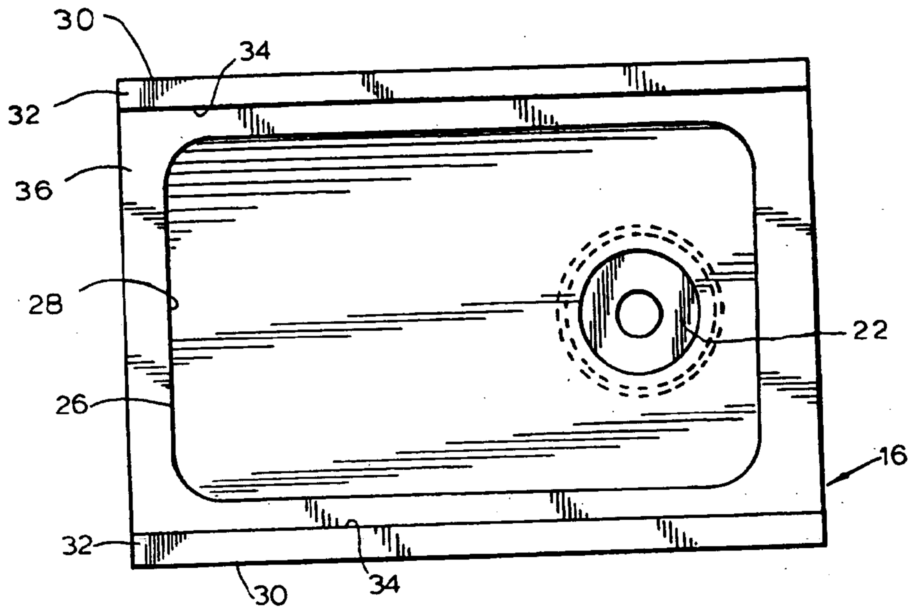


FIG 2
BOTTOM



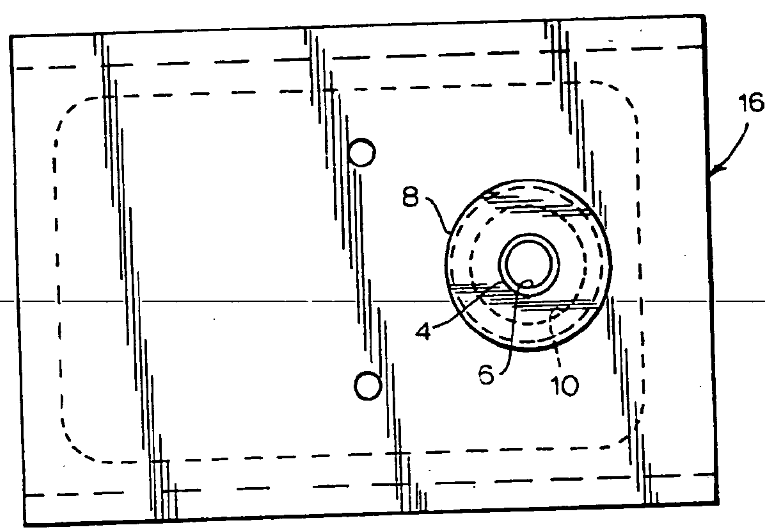


FIG. 3
TOP

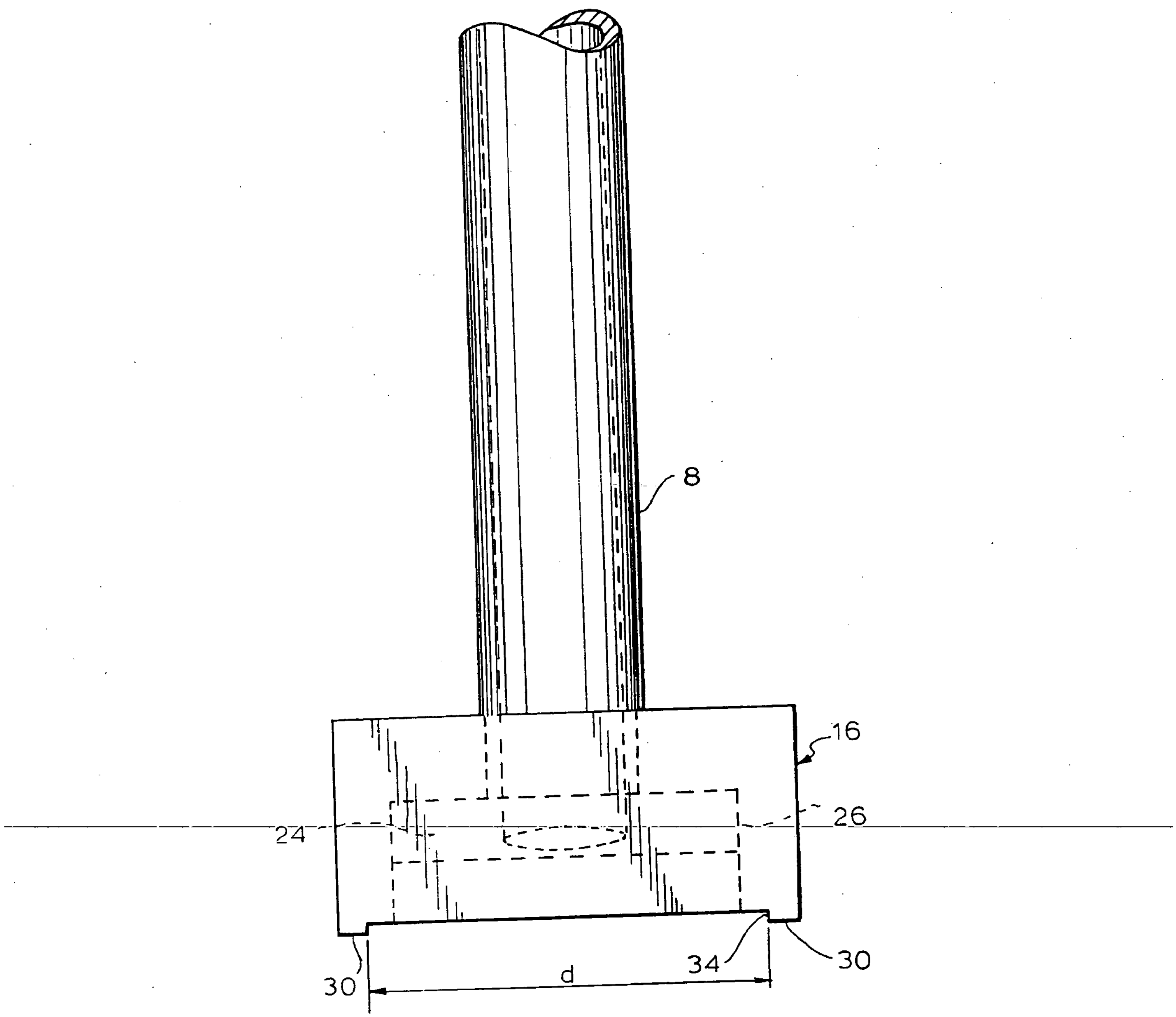


FIG 4

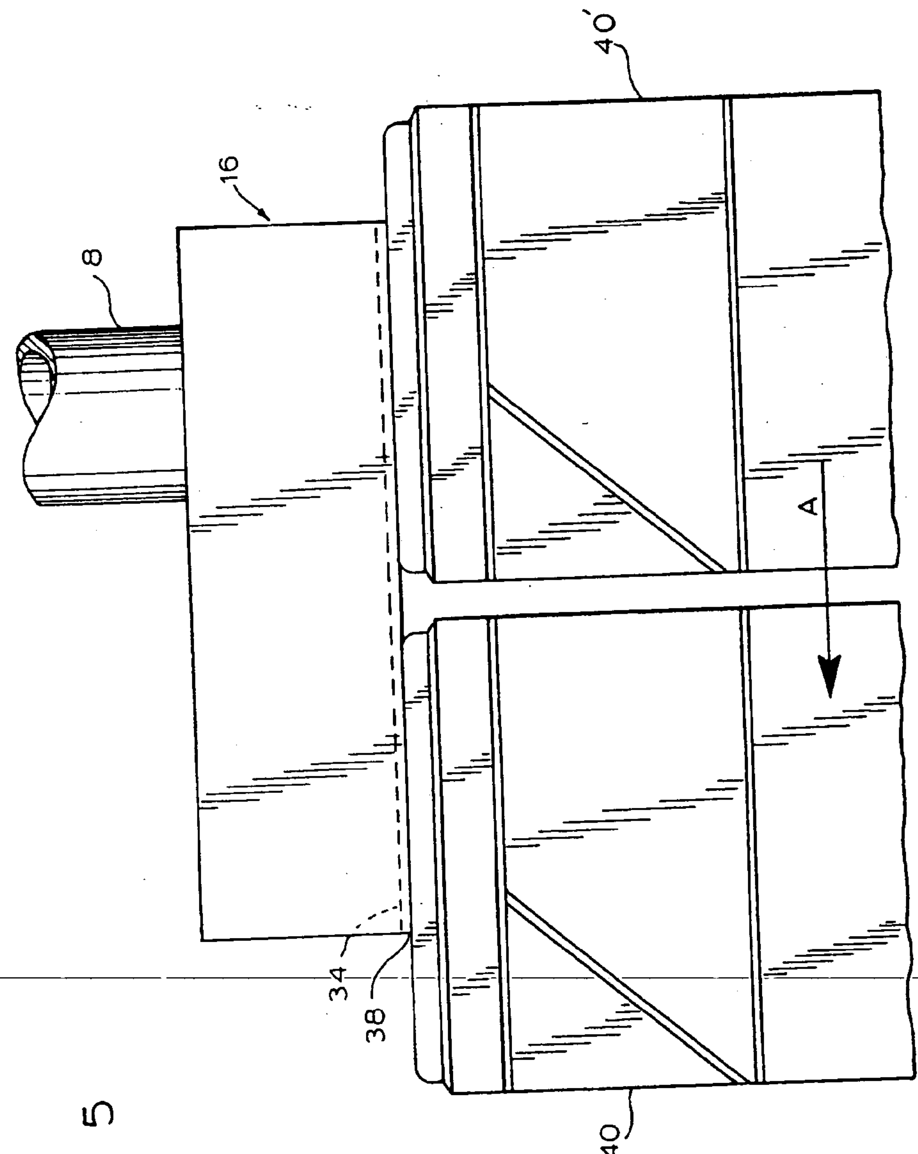


FIG 5

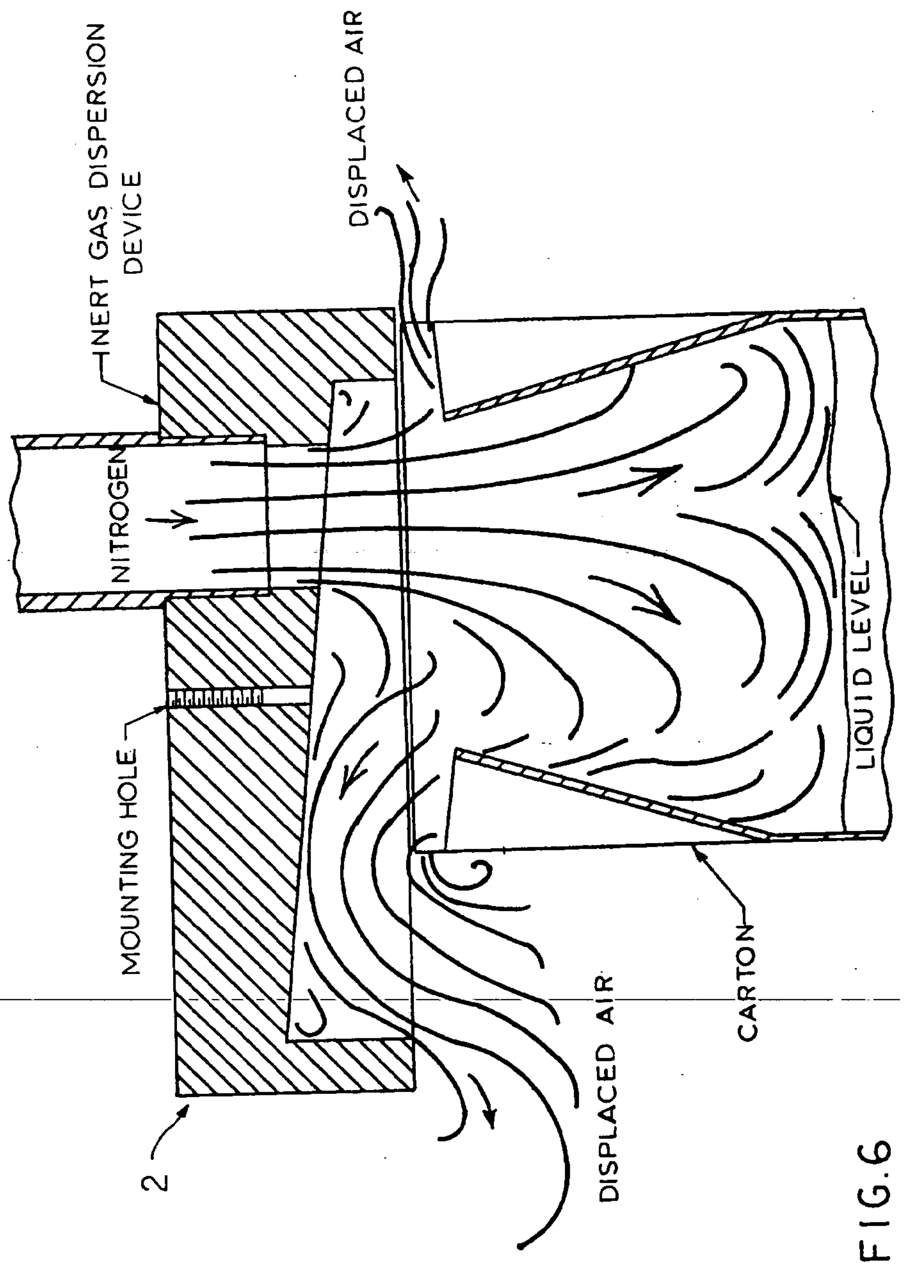

INERT GAS DISPERSION
DEVICE
DISPLACED AIR
NITROGEN
MOUNTING HOLE
LIQUID LEVEL
CARTON
DISPLACED AIR
2

FIG.6